PATENT SPECIFICATION

303,226

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COMPLETE SPECIFICATION.

Improvements in or relating to the Burning of Pulverised Fuel.

We, HENRY ADAM PROCTER, M.A., LL.B., of 20, Draycot Road, Wanstead, London, E. 11 (British), JOHN FLETCHER HOLLIDAY (British), of Astor House, Aldwych, London, W.C. 2, and THE BUELL COMBUSTION COMPANY LIMITED (British company), of Astor House, Aldwych, London, W.C. 2, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the burning of pulverised solid fuel.

In the combustion of pulverised solid fuel, it has been the practice for many years to pass pre-heated air along the main fuel carrying conduit in order to effect partial distillation of the volatile gases; which treatment possesses a defect in that the fuel particles tend to adhere together or "cokefy", with the result that the combustion is incomplete.

The primary object of the present invention is to ensure, as far as possible, complete combustion of the fuel, by preventing the adherence together of the fuel particles; and this object is attained by conveying said fuel, by the aid of primary or carrier air, into and through an atmosphere within the burner of pre-heated secondary air (i.e. the customary additional air which completes combustion), or other suitable pre-heated gaseous fluid, of such temperature as will cause the distillation or release of some or all of the volatile constituents of the fuel, so that the fuel emitted from the burner is a gaseous mixture of high inflammability.

Preferably, in order to enhance the intimacy of mixture of the volatile constituents distilled from the fuel, and the preheated secondary air, or other suitable pre-heated gaseous fluid, said pre-heated secondary air, or other suitable pre-heated gaseous fluid, is admitted to the burner at a suitable inclination to the direction of flow of the fuel.

If desired, in order to further enhance the intimacy of mixture of the volatile constituents distilled from the fuel, and the pre-heated secondary air, or other suitable pre-heated gaseous fluid, there may be imparted to the fuel, on its emergence from a delivery conduit to the burner, a vibratory or turbulent and rotary centrifuging effect; said pre-heated secondary air, or other suitable gaseous fluid, being admitted to the burner in such manner that its direction of flow is contra-wise to the direction of rotation imparted to the fuel. Said mixture may, if required, be dispersed and/or agitated in the continuation of its travel through the burner; and rotary motions may be imparted to the fuel mixture when being dispersed and/or agitated, such rotary motions being similar and contra-wise to that imparted to the fuel during its emergence from said fuel delivery conduit.

We will further describe our invention with the aid of the accompanying sheet of explanatory drawings, which illustrate, by way of example only, burner apparatus whereby the invention may be carried into effect.

In said drawings, Fig. 1 is a longitudinal section of the burner apparatus; Fig. 2 is a half transverse section, taken as on line A—A Fig. 1; and Fig. 3 is a half transverse section taken as on line B—B Fig. 1.

a, a^1 denote an outer casing, portion a^1 whereof is inwardly tapered (but said portion a^1 may, alternatively, be parallel or outwardly tapered), and near the mouth of said casing there is formed an annular internal bead or projection a^2.

Disposed within portion a of said outer casing a, a^1 is a casing b on the rear end whereof is integrally formed an end plate b^1 which is secured to said outer casing.

Formed in said inner casing b are spaced port passages b^2 which are inclinedly arranged for the purpose hereinafter described, and communicate with openings a^3 formed in portion a of the outer casing a, a^1.

Secured to said outer casing a, a^1 is a chamber c wherethrough extends a pulverised fuel delivery pipe d which terminates within said inner casing b; the discharge end of said delivery pipe d

[Price 1/-]

is suitably spaced from a fuel agitating and dispersing appliance hereinafter described.

Within the mouth of the said fuel delivery pipe d there are formed helical rifling grooves d^1, and extending through said fuel delivery pipe is a pipe rod e which carries a conical mouth piece e^1 on the outside whereof are formed vanes or rifling e^2 arranged in reverse fashion to the rifling d^1 of the fuel delivery pipe d. Said pipe rod is preferably adapted to be longitudinally adjusted in any convenient manner in order to control the length of the fuel flame and velocity of the fuel passing through delivery pipe d.

Disposed within said chamber c and abutting against said end plate b^1 of inner casing b is a disc f on which is secured a rack g wherewith a pinion h engages, said pinion being actuated by means of a rod j and a knob k located on the outside of the chamber.

Formed in said plate f are a plurality of equidistantly spaced recesses f^1, and formed in end plate b^1 of inner casing b are correspondingly spaced ports b^3. When knob k is turned, pinion h—through rack g—revolves disc f to move its port recesses f^1 into and out of register with the ports b^3; secondary air enters the casing a, a^1 by way of said ports b^3 and recesses f^1 in order to agitate the fuel mixture emerging from the burner, and to set up eddy currents.

Attached to the open end of said inner casing b and projecting into the tapering portion a^1 of the outer casing a, a^1 is a fuel agitating and dispersing appliance, comprising a carrier ring l within which are disposed two (or more) curved ring-like members m suitably spaced apart by means of curved web pieces m^1; thus diverging spiral-like passages n, n^1 are provided for the fuel. In said ring members m are formed openings or apertures m^2 in staggered relationship. In the mouth of said carrier ring l there is formed an annular internal bead or projection l^1.

In operation, pulverised solid fuel with its primary or carrier air is conveyed by pressure or induction through the burner by way of delivery pipe d. In passing the rifling d^1 formed within the mouth of said delivery pipe, a vibratory or turbulent and rotary centrifuging effect is imparted to the fuel during its emergence from the pipe. Pre-heated secondary air, or other suitable pre-heated gaseous fluid, is admitted through ports b^2 of the inner casing b, and, due to the "set" of said ports, said air or other gaseous fluid enters the burner at an inclination to the direction of flow of the fuel, and so meets said fuel in a direction contra-wise to its direction of rotation, and some or all of the volatile constituents of the fuel are distilled or released in the burner space A.

This mixture, which is highly combustible, is now further atomised and expanded in its passage through said agitating and dispersing appliance, as the vanes or rifling e^2 and inclined passages n^1 tend to impart a rotary motion to some of the fuel in a contra-wise direction to that imparted by the rifling d^1, whilst a reverse rotational motion (i.e. similar to that imparted to the fuel by the rifling d^1) is imparted to the remainder of the fuel in its passage through the spaces n. The fuel is also dispersed on being forced through the "staggered" apertures m^2, and its flow is momentarily checked by the annular bead or projection l^1 which also assists atomisation. Thus the mixture is in a continuous state of agitation due to eddy currents and is expanded in its passage through said agitating and dispersing appliance.

On emergence from said agitating and dispersing appliance the mixture is met by—preferably pre-heated—secondary air which is admitted through suitable ports (not shown) into chamber c and passes therefrom—by way of the air-controlling ports f^1, b^3—into outer casing a, a^1; the fuel particles are thereby agitated and scrubbed with a fresh supply of oxygen and the mixture is again momentarily checked by the annular bead or projection a^2 which tends to enhance its atomisation at and about the mouth of the tapering portion a^1 of the outer casing a, a^1, at which point combustion takes place; and, as the fuel is emitted from the burner as a gaseous mixture of high inflammability, the fine fuel particles are prevented from adhering together, and the common defect of "coking" is obviated.

If desired, air and/or superheated steam may be delivered to the burner through the pipe rod e, in order to facilitate combustion of the fuel; or/and for the purpose of igniting the fuel when the burner is being started up, there may be associated with said pipe rod e a suitable atomising device through which air and liquid fuel may be delivered under pressure to said pipe rod.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In the burning of pulverised solid

fuel, conveying said fuel, by the aid of primary or carrier air, into and through an atmosphere within the burner of pre-heated secondary air (i.e. additional air which completes combustion), or other suitable pre-heated gaseous fluid, of such temperature as will release some or all of the volatile constituents of the fuel, so that the fuel emitted from the burner is a gaseous mixture of high inflammability.

2. In the treatment of pulverised solid fuel as claimed in the preceding claim, admitting said pre-heated secondary air, or other suitable pre-heated gaseous fluid, to the burner at a suitable inclination to the direction of flow of the fuel.

3. In the treatment of pulverised solid fuel, as claimed in either of the preceding claims, imparting a vibratory or turbulent and rotary centrifuging effect to the fuel during its emergence from a delivery conduit to the burner, and admitting said pre-heated secondary air, or other suitable pre-heated gaseous fluid, to the burner in such manner that its direction of flow is contra-wise to the direction of rotation of said pulverised solid fuel, so that an intimate mixture of said volatile constituents distilled from the fuel and said secondary air, or other suitable gaseous fluid, is formed.

4. In the treatment of pulverised solid fuel, as claimed in any one of the preceding claims, causing the mixture of said volatile constituents distilled from the fuel and said pre-heated secondary air, or other suitable pre-heated gaseous fluid, to be dispersed and/or agitated in the continuation of its travel through the burner.

5. In the treatment of pulverised solid fuel as claimed in the preceding Claim 4—and in which fuel treatment a vibratory or turbulent and rotary centrifuging effect is imparted to the fuel during its emergence from a delivery conduit to the burner—imparting rotary motions to the mixture of said volatile constituents distilled from the fuel and said pre-heated secondary air, or other suitable pre-heated gaseous fluid, when being dispersed and/or agitated; said rotary motions being similar and contra-wise to that imparted to the fuel during its emergence from said fuel delivery conduit.

6. In the treatment of pulverised solid fuel, as claimed in any one of the preceding claims, admitting, in the manner described, pre-heated secondary air, or other suitable pre-heated gaseous fluid, to the mixture of pulverised fuel and primary air, for the purpose specified.

7. For use in the treatment of pulverised solid fuel according to the method in which the fuel is conveyed by the aid of primary or carrier air into and through an atmosphere within the burner of pre-heated secondary air, or other suitable pre-heated gaseous fluid; a burner which includes means whereby said pre-heated secondary air, or other suitable gaseous fluid, may be admitted to the burner at a suitable inclination to the direction of flow of the fuel, for the purpose specified.

8. In a burner adapted for the combustion of pulverised solid fuel, as claimed in Claim 7, means whereby a vibratory or turbulent and rotary centrifuging effect is imparted to the fuel during its emergence from a fuel delivery pipe, and air ports or passages whereby pre-heated secondary air, or other suitable pre-heated gaseous fluid, may be admitted to said fuel in such manner that its direction of flow is contra-wise to the direction of rotation of the fuel when issuing from said fuel delivery pipe.

9. In a burner adapted for the combustion of pulverised solid fuel, as claimed in either of the preceding Claims 7 or 8, the provision in front—and suitably spaced from—the mouth of the fuel delivery pipe, of a fuel dispersing and/or agitating appliance.

10. In a burner adapted for the combustion of pulverised solid fuel as claimed in either of the preceding Claims 7 or 8, a fuel mixture dispersing and/or agitating appliance, substantially as hereinbefore described, and illustrated in the accompanying drawings.

11. In a burner adapted for the combustion of pulverised solid fuel, as claimed in any one of the preceding Claims 8 to 10, inclusive, a pipe rod extending through said fuel delivery pipe, and preferably longitudinally adjustable, and at the end whereof are formed means whereby rotary motion may be imparted to the fuel mixture in a direction contra-wise to that imparted by the delivery pipe, for the purpose specified.

12. In a burner adapted for the combustion of pulverised solid fuel, as claimed in any one of the preceding Claims 7 to 11, inclusive, and which burner includes inner and outer casings, the provision of means whereby secondary air may be delivered through the space between said casings and caused to set up eddy currents, for the purpose specified.

13. In a burner adapted for the combustion of pulverised solid fuel, as claimed in any one of the preceding Claims 7 to 12, inclusive, the provision of means whereby the flow of fuel may be momentarily checked, for the purpose specified.

14. A burner adapted for the combus-

tion of pulverised solid fuel, substantially as hereinbefore described, and illustrated in the accompanying drawings.

Dated this 12th day of October, 1927.
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139, Dale Street, Liverpool,
Applicant's Patent Agent.

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[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

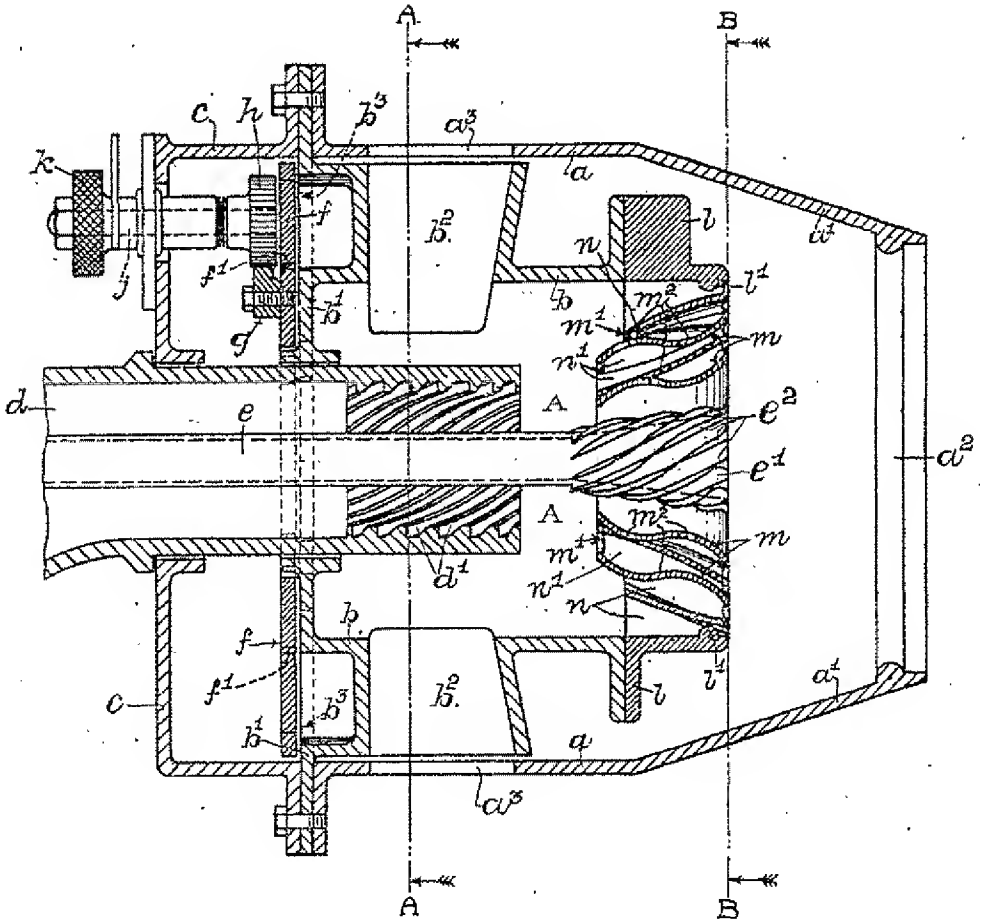

Fig. 2.

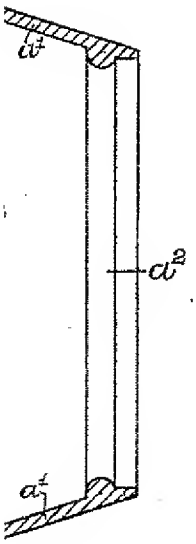

Fig. 3.

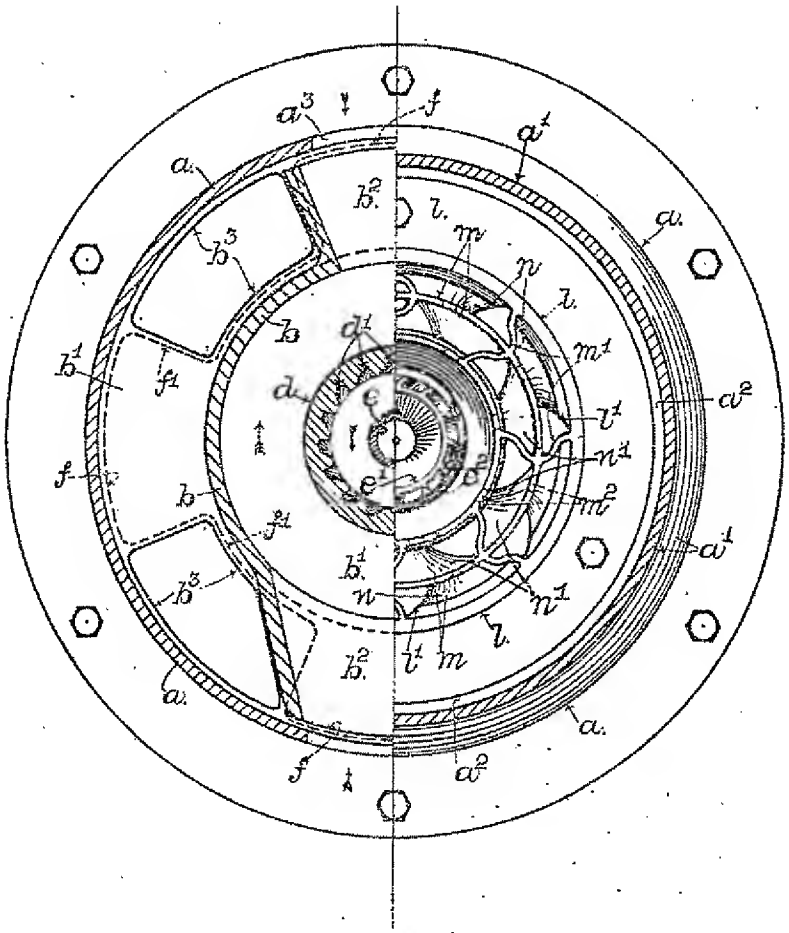

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Fig.1.

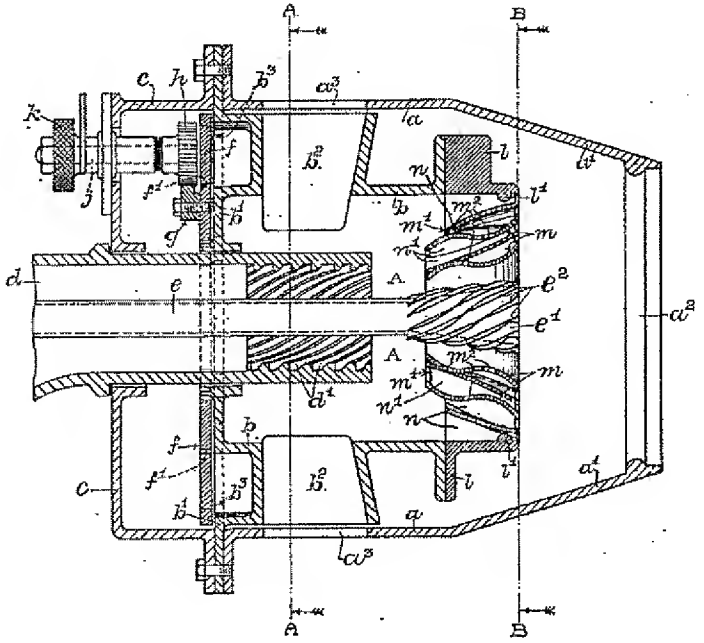

Fig.2.

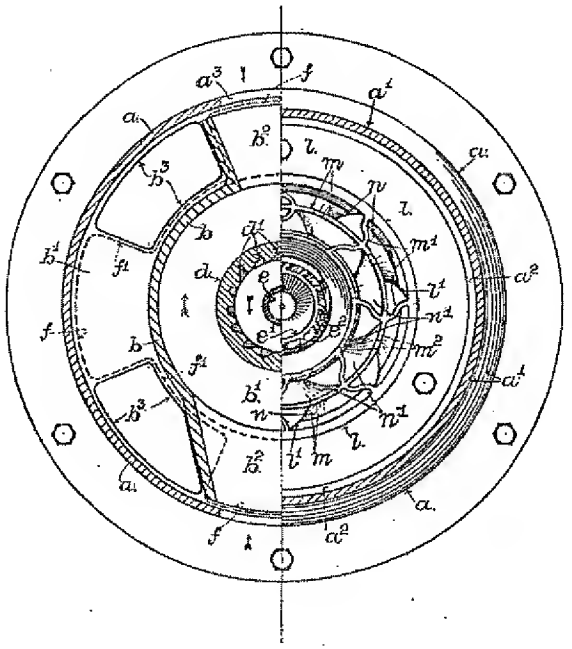

Fig.3.

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